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Air Quality Assessment, ACase Study Of Petroleum Training Institute Effurun, Nigeria

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ABSTRACT : *One of the basic requirement for human health and well-being is clean air. Conversely, most developing and under-develop countries did not have access to clean air. Hazardous gases such as Carbon (II) oxide (CO), Hydrogen Sulphide (H_2S), etc. that are liberated from Industrial and household activities have huge negative effect on human health if inhaled. Air pollution continues to pose a significant threat to human healthy worldwide. According to the World Health Organization's (WHO), assessment on air quality, in relation to the burden of disease due to air pollution is more than two million premature deaths. Considering the usefulness of clean air, the quality of air within Petroleum Training Institute, Effurun, Nigeria was investigated using an automatic digital multi gas tester (AEROQUAL AIR TESTER S200). The parameters that were analyzed were CO_x, NO_x, SO_x and PM_{10}. The results show various levels of gaseous pollutants. The maximum concentration PM_{10} was 149.6 µg/m^3 (1.00 pm of day 3) and the minimum was 87.3 µg/m^3 (11.00 am of DAY 3). The concentration of SO_2 was highest at 97.21 µg/m^3 (4.00 pm of Day 1) and was lowest at 53.55 µg/m^3 (1.00 pm of DAY 2), CO has a maximum concentration of 11.00 µg/m^3 (1.00 pm of day 3) and the lowest was 4.00 µg/m^3 (2.00 pm of DAY 2). Besides, the concentration of CO in the atmosphere is below the stipulated limits of FEPA. The concentrations of other gaseous pollutants that were analyzed on and were discovered to be below the Federal Ministry of Environment air quality limits. Therefore, the air within the study area is clean, and if inhale will have no negative effect on human health.*

KEYWORDS-*Air quality assessment, gaseous pollutants, concentration, human health, Nigeria*

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I. INTRODUCTION

Environmental pollution is a major problem both in developing, undeveloped and developed countries. However, the lack of environmental pollution awareness in Nigeria for so long could be ascribed principally to ignorance on the part of policy makers as well as the general citizenry in whose perceptions, pollution was thought to arise from industries activities alone [1]. Air pollution is the contamination of the indoor and outdoor environment by a chemical, physical or biological agent or substance that modifies or alters the natural characteristics and composition of the atmosphere, which could cause harm to humans or other living organisms within the environment [2-4]. Household combustion devices, motor vehicle, industrial facilities and forest fires are some of the common sources of air pollution. Atmospheric pollutants that cause major public health and environment concerns include particulate matter, Carbon (IV) oxide (CO_2), Carbon monoxide (CO), Nitrogen (IV) oxide (NO_2), Sulphur (IV) oxide (SO_2), Ozone [5-6], etc.

Clean air is considered to be a basic requirement for human health and well-being. However, air pollution continues to pose a significant threat to human healthy worldwide. According to the World Health Organization's (WHO), assessment on air quality, in relation to the burden of disease due to air pollution is more than two million premature deaths. This yearly occurrence can be attributed to urban outdoor air pollution and indoor air pollution. More than half of this disease burden is borne by the populations of "developing countries", of which Nigeria is one [7-10]. The need to have a clean and high quality air cannot be over-emphasized. The rationale behind this study arises from the necessity to sensitize, inform, and educate the public and general populace on the excessive air pollution in our environment. Hence, this research works that is aimed at carrying out a routing assessment on the ambient air quality within the premises of Petroleum Training Institute Effurun, Nigeria. Also, the study is concerned with the evaluation of the concentration of four most

common air pollutants; which are: Carbon (II) oxide, Sulphur (IV) oxide, Nitrogen (IV) oxide, and particulate matter (PM_{10}); and establish their conformity with guidelines and standards.

Petroleum Training Institute is located in Effurun (Warri) which is a major city in the oil producing state of Delta, Nigeria. Effurn is the capital town of Uvwie Local Government Area of Delta State, Nigeria. She is highly populated and is a gateway into the City of Warri, Nigeria. It is a tertiary institute for training of technological man power for oil and gas, and other allied industries in the Niger Delta area of southern Nigerian. Warri has an estimated population of about 500,000 people according to the 2006 National Population Census. It is at the centre of major oil and gas exploration, production, processing and subsequent shipping of these processed petroleum products. Its geographical coordinates are $5^0 31´N 5^0 34´E$. Figure 1 shows the map of Effurun.

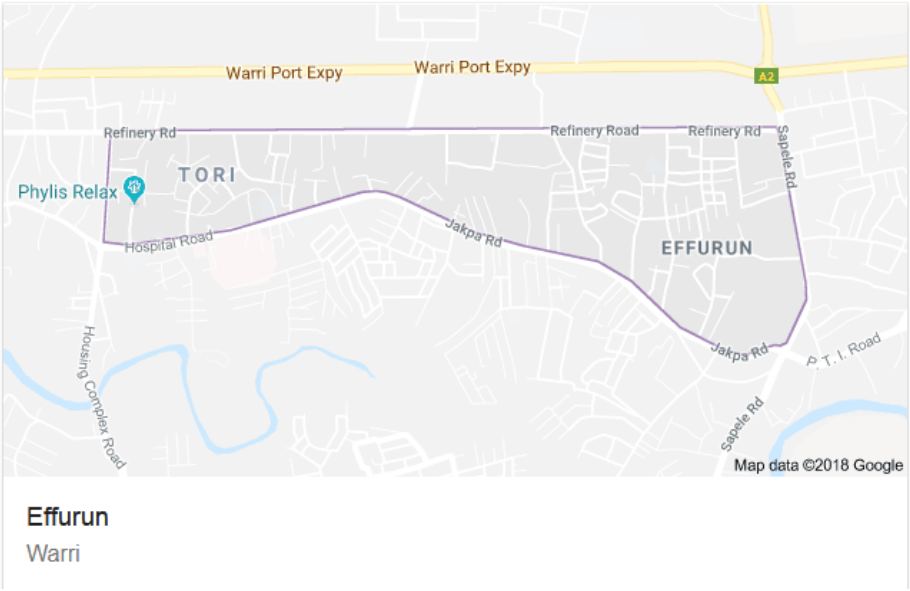

Figure 1: Map of Effurun

II. MATERIAL AND METHOD

2.1 Equipment/Apparatus Used

Aeroqual air tester SERIES S200 was used for this research work.

2.2 Sample Collection

Aeroqual air tester series S200 was used to collect air samples and analyzed. The device consists of different sensors for detection of gases. It has Gas Sensitive Semi-Conductor (GSS)' sensors for measuring and analyzing different pollutants present in the atmosphere. It operates by sucking and analyzing the air sample for a period of about three to five minutes, and then the results is displayed on the screen. Aeroqual Air Quality tester 8200 is fully factory calibrated and required no field calibration before use.

2.3 Sampling Point

The air quality analysis test was carried out in petroleum training Institute (PTI) which is located at Effurun, Uvwie Local Government Area of Delta State. Various locations were chosen as the sampling point and this is to determine the quality of air taken in by students and staff inside the school premises.

2.4 Sampling Duration

Measurements were taken on an hourly basis for seven (7) hours per day. Measurement of each parameters lasted for a period of 5 minutes per hour.

III. RESULTS AND DISCUSSION

The results obtained for the analysis of the various air samples were as tabulated as depicted in the tables and figures. Table 1 shows the concentration of pollutants in air samples for day 1 while Figure 2 shows the bar chart of concentration of pollutants in air samples for day 1.

Table 1: Concentration of Pollutants in Air Samples for Day 1.

	Day 1 Result							
Parameter	**9A.M**	**10A.M**	**11A.M**	**2 .M**	**1 P.M**	**2 P.M**	**3 P.M**	**4 P.M**
SO_X (µg/m^3)	75.170	63.300	58.410	67.150	69.990	72.230	87.290	97.210
NOx (µg/m^3)	0.009	0.008	0.008	0.009	0.008	0.010	0.013	0.012
CO_X (µg/m^3)	10.000	8.000	6.000	7.000	5.000	6.000	6.000	8.000
SPM (µg/m^3)	118.400	96.200	87.300	99.500	102.500	101.300	100.700	124.300

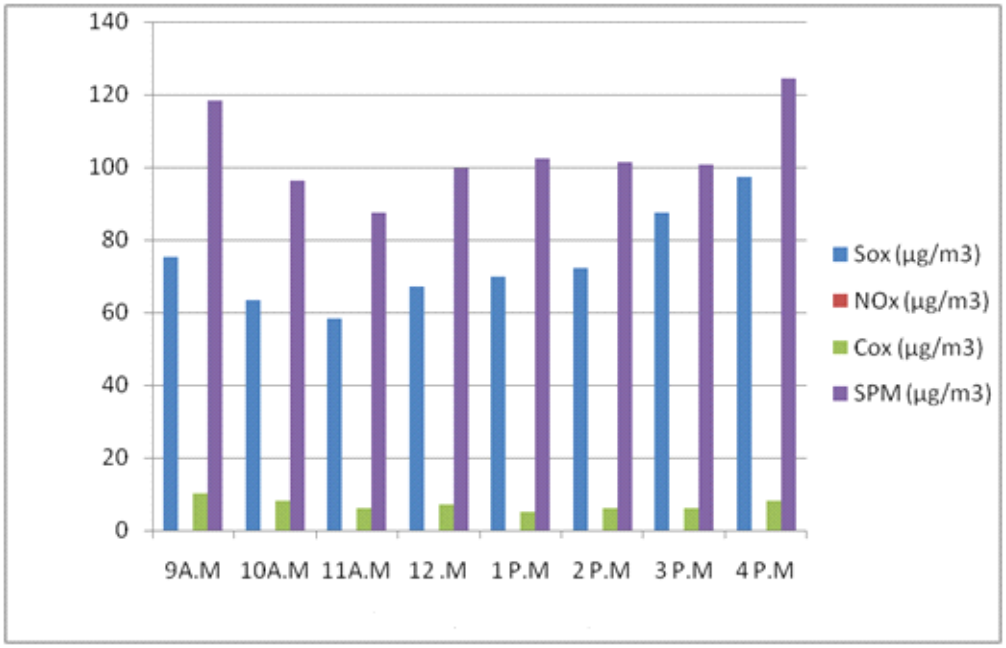

Figure 2: Bar Chart Showing Concentration of Pollutants in Air Samples for Day 1

Figure 3 shows the graph of concentration of air pollutants against time for day one.

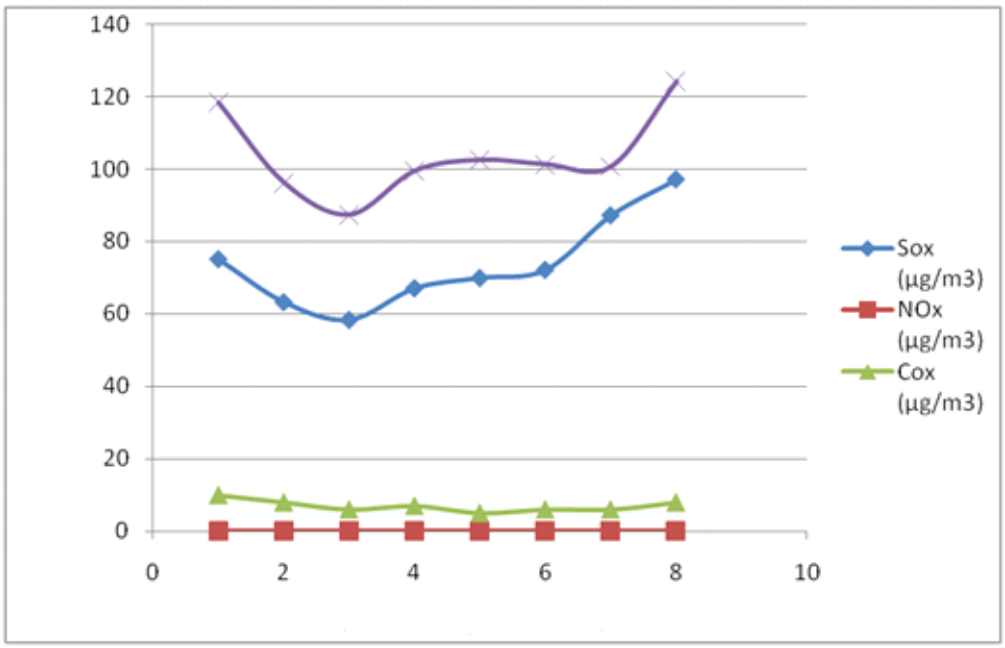

Figure 3: Graph of Concentration of Air Pollutants against Time for Day 1.

Table 2 shows the concentration of pollutants in air sample for day two (2).

Table 2: Concentration of Pollutants in Air Samples for Day 2

	Result							
Parameter	**9A.M**	**10A.M**	**11A.M**	**12 .M**	**1 P.M**	**2 P.M**	**3 P.M**	**4 P.M**
SO_X (µg/m^3)	69.110	61.830	55.810	56.190	53.550	64.890	74.290	90.840
NOx (µg/m^3)	0.004	0.007	0.005	0.006	0.005	0.004	0.005	0.006
CO_X (µg/m^3)	8.000	7.000	8.000	6.000	7.000	4.000	8.000	10.000
SPM (µg/m^3)	120.400	115.300	109.900	125.600	127.800	124.100	129.500	137.200

Figure 4 shows the bar chart showing concentration of pollutants in air samples for day two (2).

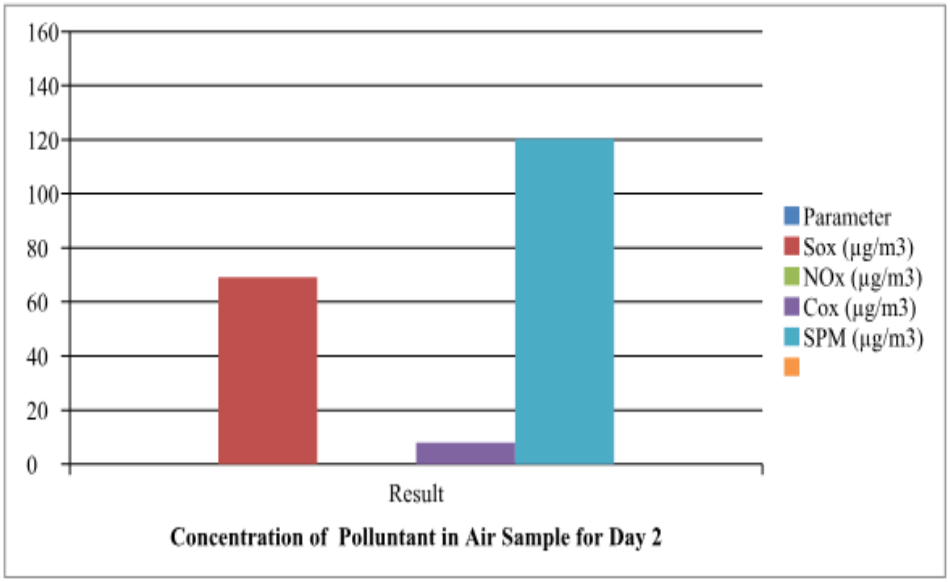

Figure 4: Bar Chart Showing Concentration of Pollutants in Air Samples for Day 2

Figure 5 shows the graph of concentration of air pollutants against time for day two (2).

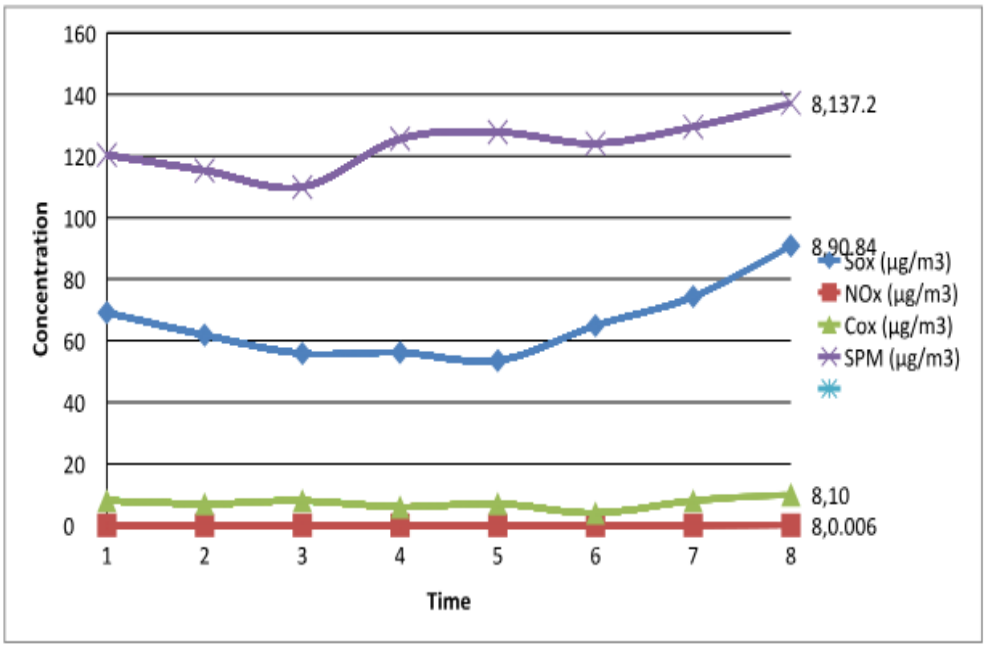

Figure 5: Graph of Concentration of Air Pollutants against Time for Day Two (2).

Table 3 shows the concentration of pollutants in air samples for day 3.

Table 3: Concentration of Pollutants in Air Samples for Day 3.

	Result							
Parameter	**9A.M**	**10A.M**	**11A.M**	**12 .M**	**1 P.M**	**2 P.M**	**3 P.M**	**4 P.M**
SO_X (µg/m^3)	54.230	55.120	62.530	59.250	57.770	60.180	82.180	91.640
NOx (µg/m^3)	0.007	0.003	0.006	0.004	0.006	0.007	0.008	0.004
CO_X (µg/m^3)	6.000	9.000	8.000	10.000	11.000	7.000	8.000	7.000
SPM (µg/m^3)	131.000	122.300	133.900	143.000	149.600	128.300	136.600	140.200

Figure 6 shows the bar chart showing concentration of pollutants in air samples for day three (3).

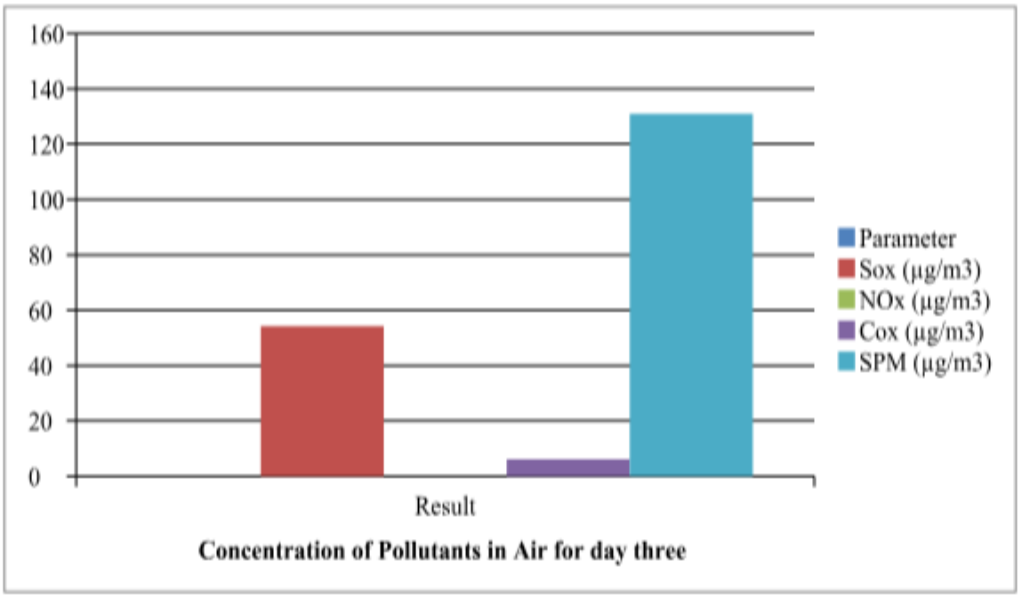

Figure 6: Bar chart showing Concentration of Pollutants in Air Samples for Day Three (3).

Figure 7 shows the graph of concentration of air pollutants against time for day three (3).

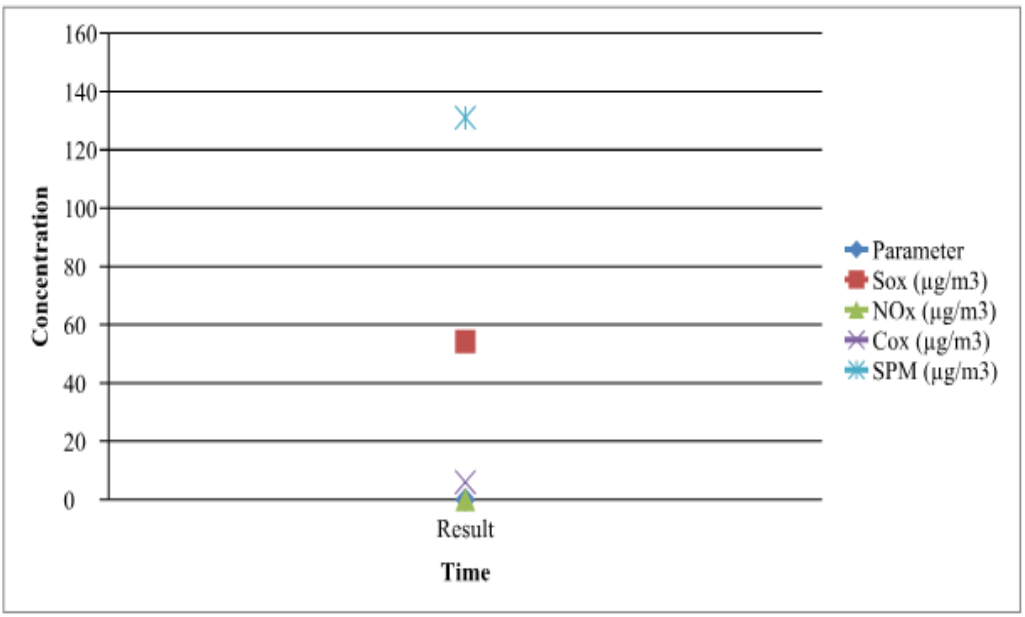

Table 4 shows the daily Average of suphlur (IV) oxide (So_x gases)

Table 4: Daily Average of Sulphur (IV) oxide

	Average Means			Air Quality Standard
SO_X	**Day 1**	**Day 2**	**Day 3**	
	73.844	65.814	65.363	300

Figure 8 shows the bar chart of daily average of Sulphur (IV) oxide

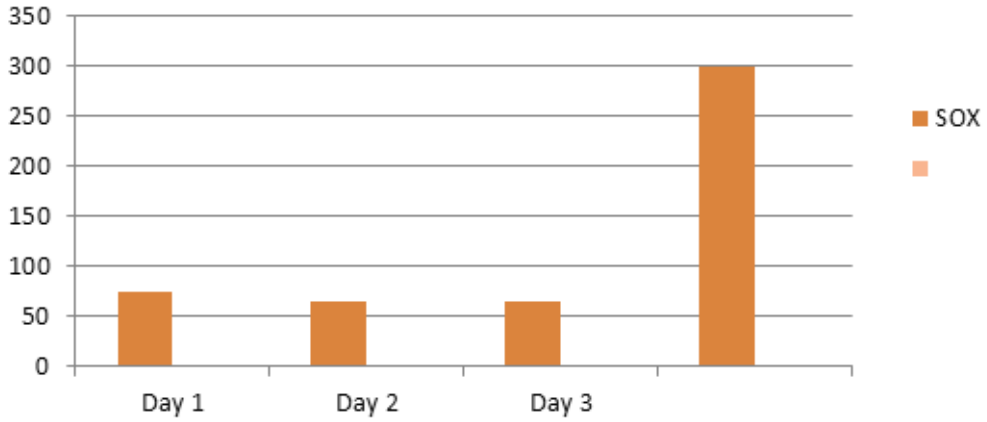

Figure 8: Bar chart of Daily Average of Sulphur (IV) oxide

Table 5 shows the daily average of Nitrogen oxide gases (NO_x gases)

Table 5: Daily Average of Nitrogen oxide gases (NO_x gases)

	Average Means			Air Quality Standard
	Day 1	**Day 2**	**Day 3**	**FEPA**
NO_X	0.001	0.005	0.006	120

Table 6 shows the daily average of Carbon (II) oxide gases (NO_x gases)

Table 6:Daily Average of Carbon (II) Oxide (Co_x gases)

	Average Means			Air Quality Standard
	Day 1	**Day 2**	**Day 3**	**FEPA**
CO	7.000	7.250	8.250	11.4

Figure 9 shows the bar chart of daily average of Carbon (II) oxide

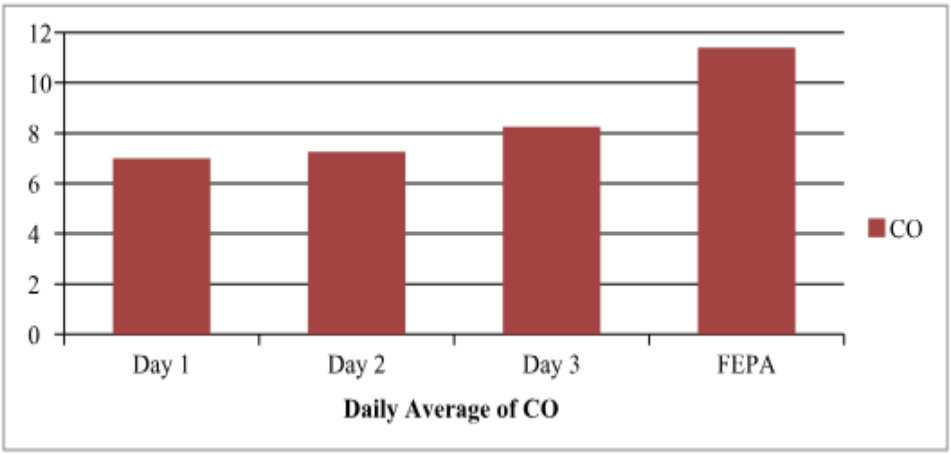

Figure 9: Bar Chart of Daily Average of Carbon (II) oxide

Table 7 shows the daily average data of SPM (particulate matter)

Table 7:Daily Average Data of SPM (Particulate Matter)

	Average Means			Air Quality Standard
	Day 1	Day 2	Day 3	FEPA
PM	103.775	123.725	135.613	250

Figure 10 shows the bar chart of average data SPM.

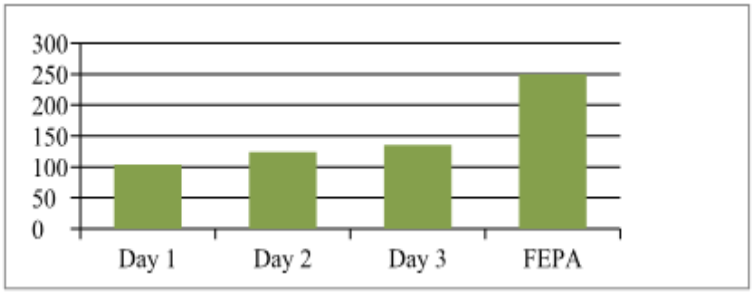

Figure 10: Average Data of SPM.

As shown in the tables and figures, the data gotten for Carbon (II) oxide (CO) were below the stipulated limits. The highest measured data for the duration of analysis was 11.00µg/m^3 (1.00 pm day 3) and the lowest was 4.00µg/m^3 (2.00 pm day 2). The calculated mean data for the three days duration were 7.000µg/m^3, 7.250µg/m^3, and 8.250µg/m^3, for day 1, day 2 and day 3 respectively. When compared with Air Quality Standards, it was below the FEPA limit of 11.4µg/m^3. The data for Nitrogen oxides (NOx gases) ranges from 0.004µg/m^3 (i.e., as the lowest value measured) to 0.013µg/m^3 (i.e., as the highest value measured. The calculated means value for each day were below the limit as stipulated by Federal Ministry of Environment, an environmental regulatory body in Nigeria. The amount of NOx gases in the atmosphere is relatively small. Some of the NOx gases may have reacted with the water vapour, or the rain to form acid rain.

IV. CONCLUSION

Air pollution is a major environmental risk to health. If the air pollution level is low, the global burden of disease resulting from respiratory infections, lung cancer and heart disease will not be rampant. After the analysis and assessment of the ambient air in the study area, the results show that Carbon (II) oxide (CO) is low in the area. The concentration of CO in the atmosphere is below the stipulated limits of Federal Ministry of Environment. The concentrations of other gaseous pollutants that were analyzed on and were discovered to be below the Federal Ministry of Environment air quality limits. This implies that those who stay at the side of the road all day, security men at the school gate, staff and student and workers of the Petroleum Training Institute, as well as the general residents are safe of gaseous pollution.

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